Space Weather Technical Forecast

Issued on Sunday, 13 November 2022 at 00:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of further M-class flares (R1-R2/Minor to Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been Moderate, with one M-class flare (M1.1) from AR3141 at 12/0018 UTC. A period of more enhanced C-class activity also occurred 12/1400-2000 UTC, culminating in C6 flare at 12/1804 UTC, also from AR3141.

There are currently three numbered regions on the visible disc, all located in the northwest quadrant. AR3141 remains the most significant region, although has decreased in overall size through the period. AR3140 has seen further spot development on its southern flank with more prominent small umbrae developing. The remaining region, AR3145, continues weak with just several small spots.

No Earth-directed CMEs (Coronal Mass Ejections) have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1, saw a gradual, albeit erratic increase from around 420 km/s to a peak near 500 km/s around 12/1800 UTC, with a slight decrease thereafter. Density has been average with a generally flat trend. Total magnetic field strength (IMF) was peaked at 13 nT near the start of the period, before tapering off to a steady 7 nT. The north-south component, Bz, fluctuated moderately at first +10/-8 nT, before returning to weak and mostly positive levels. Phi angle has been negative (towards the Sun). Geomagnetic activity was Unsettled (Kp 3) on the first synoptic interval, otherwise Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 has been at background to moderate levels, with a peak of 138 pfu at 12/1930 UTC. Electron fluence levels remained well below Active levels with a sharp decline through the period. Observed fluence at 13/0001 UTC was 1.87e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be generally Low, with a chance of further isolated M-Class flare activity. The most likely source of activity is from the largest and most complex region AR3141, and also AR3140

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently forecast. Although some faint ejecta, perhaps associated with occasional flare activity over the past couple of days, cannot completely be discounted as having some Earth directed trajectory, any potential impacts would be expected to be weak.

Solar winds are currently at slightly elevated levels, due to ongoing coronal hole influence.

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Winds are expected to return towards slow-ambient levels over the next couple of days as HSS effects wane. CH45 will rotate into a potentially geoeffective position by day 3 (15 November), and may give a weak enhancement to solar winds, although confidence is low as this is not a recurrent feature. However, enlil model forecasts do hint that this is a possibility.

Geomagnetic activity is expected to be predominantly Quiet to Unsettled through the period, perhaps with a slight chance of isolated Active intervals around day 3 (15 November).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES-16 is expected to remain at background levels. There may be a slight increase in the probability of solar radiation storms through days 2 to 4.. Electron flux is forecast to be at background to moderate levels throughout the period. Fluence values are expected to remain below or well below Active throughout the period.

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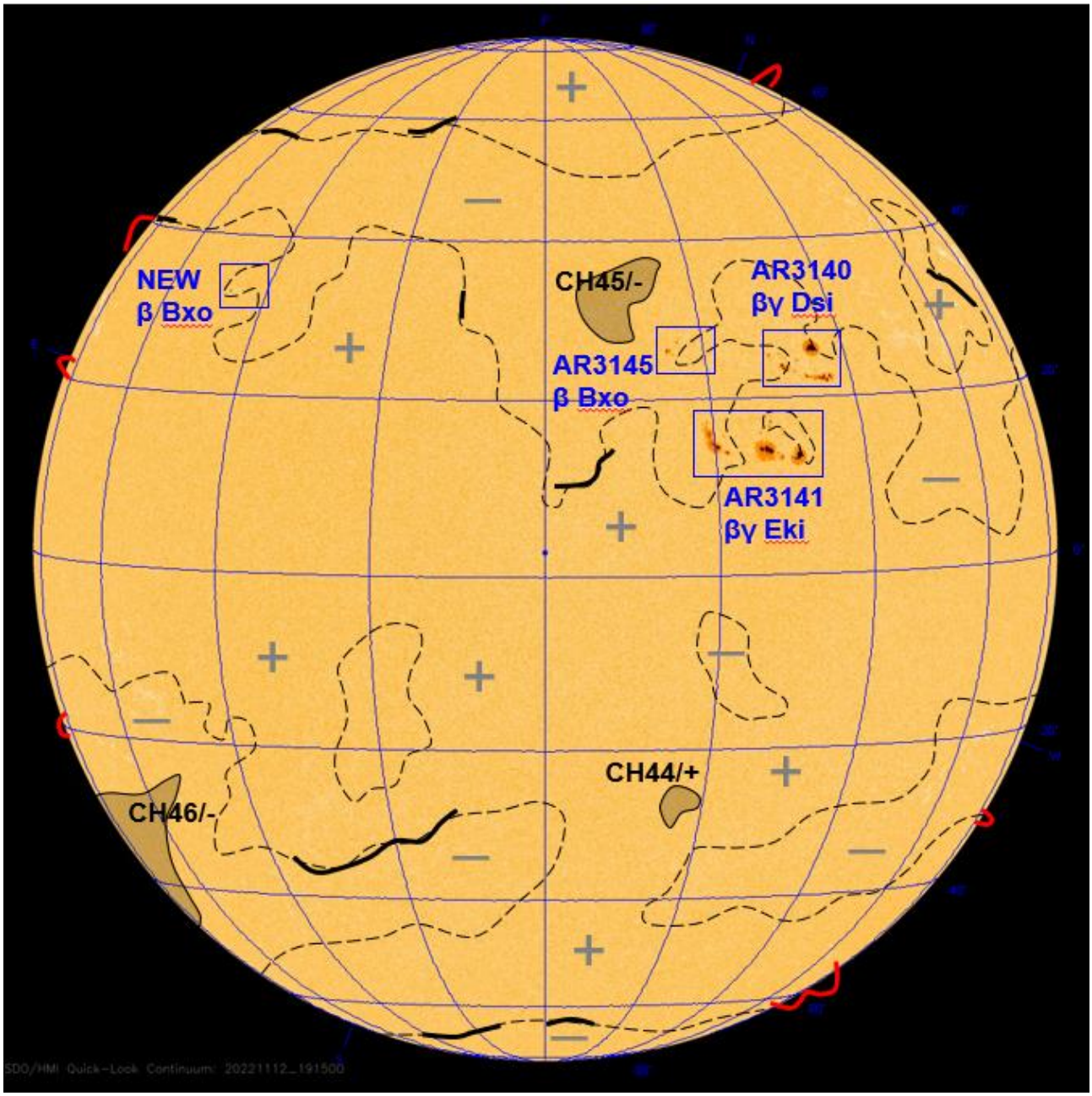
Figure 1. Solar Analysis Valid 12/1930 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are currently forecast. Although some faint ejecta, perhaps associated with occasional flare activity over the past couple of days, cannot completely be discounted as having some Earth directed trajectory, any potential impacts would be expected to be weak. Solar winds are currently at slightly elevated levels, due to ongoing coronal hole influence. Winds are expected to return towards slow-ambient levels over the next couple of days as HSS effects wane. There are two small coronal holes on the visible disc, CH45 now just in the northwest quadrant and CH44 in the southwest. CH45 will rotate into a potentially geoeffective position by day 3 (15 November), and may give a weak enhancement to solar winds, although confidence is low as this is not a recurrent feature. However, enlil model forecasts do hint that this is a possibility.

Geomagnetic activity is expected to be predominantly Quiet to Unsettled through the period, perhaps with a slight chance of isolated Active intervals around day 3 (15 November).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

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Radio Blackouts - X-Ray Flares:

Solar activity is expected to be generally Low, with a chance of further isolated M-Class flares. The most likely source of activity is from the largest and most complex region AR3141 Eki/Beta-Gamma, and also AR3140 Dsi/Beta-Gamma. Two potential returning regions are due to cross the eastern limb over the coming days and these regions may additionally contribute to the overall flare risk.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at Background levels and is forecast to remain at this level throughout the period. As AR3141 and AR3140 transit across the western solar hemisphere there is a slight increase in the probability of proton storms.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	10	10	10
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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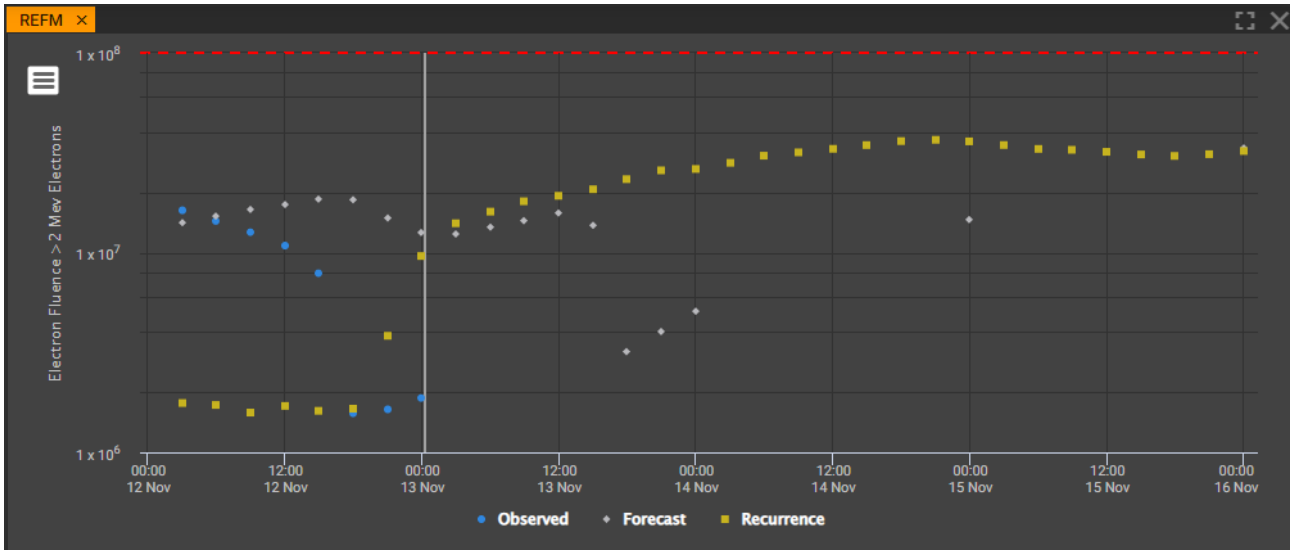
High Energy Electrons Event (≥ 2MeV):

Electron flux (greater than 2MeV) is currently at Background to Moderate levels. Electron flux is forecast to remain at predominantly Background to Moderate levels through the period. Electron fluence values are well below the Active (1e8 integrated pfu) threshold and are expected to remain so throughout the period, with a largely flat trend most probable. The MOSWOC REF Model currently supports electron fluence values remaining below the 1e8 Active threshold, however, model confidence in absolute values is low.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 2: MOSWOC REFM



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